

CHAPTER 9

POTENTIAL MEASURES TO ENCOURAGE ALTERNATIVE TRANSPORTATION FUELS AND VEHICLES

9.1 INTRODUCTION

In contrast to the marine and aviation sectors, where there is minimal potential for state involvement with respect to energy use, the ground sector is both large enough to be significant¹ and amenable to influence by the state. Therefore, since governmental involvement may assist in achieving energy goals, it is informative to present possible governmental actions to develop alternative fuel use in the state's ground transportation sector. The presentation is structured by degree of government involvement. This Chapter is limited to a description of the possible range of measures. A suggested program is deferred to Chapter 11.

9.2 DISTINGUISHING MEASURES BY DEGREE OF GOVERNMENT INVOLVEMENT

As shown in Table 9-1, Government involvement can range from large (the government provides fuels) to relatively small (e.g. weak incentives). With any approach, the government can also sponsor and lead research, development, and demonstration (RDD) programs.

Tables 9-2 and 9-3 show possible government actions organized by their aims. Measures focusing on alternative fuel supply and infrastructure development are shown in Table 9-2. Measures focusing on alternative fuel vehicles (AFVs) are shown in Table 9-3. These tables contain governmental measures that might be taken. Some measures are further characterized by an "S" (a measure primarily affecting the supply of alternative fuels or AFVs) or a "D" (a measure primarily affecting the demand for alternative fuels or AFVs).

9.2.1 GOVERNMENT-PROVIDED FUEL

Government-provided fuel entails the highest degree of government involvement with the following governmental roles:

- fuel selection;
- investment;

¹ See Chapter 2.

Table 9-1

Lead Roles in Different Implementation Approaches

In this implementation approach...	who has the lead or chief role in...			
	Setting Research, Development, and Demonstration Agenda	Choosing Favored Fuels	Pricing and Marketing Fuels	Investing in Fuel Production Facilities
Government provided fuel Financial incentives Mandates/requirements/standards	Government Government Government	Government Government Government or Industry	Government Government Industry	Government Industry Industry

Table 9-2

Possible Measures to Promote Alternative-Fuels Use and Fuel Infrastructure Development

RDD	Requirements/Standards	Incentives	Government Investment
<ul style="list-style-type: none"> Government RDD on alternative-fuel technologies 	<ul style="list-style-type: none"> Gasoline and diesel fuel nonpetroleum or oxygenate content standards (S)* Fuel pool averaging based on fuel type or petroleum content (S)¹ Fuel pool averaging based on fuel cleanliness (S)^{3,6} Fuel availability/distribution requirement (S) Domestic content requirement (S) Electric vehicle charging system requirements (S) Tank methanol/ethanol compatibility rule (S) Use-permit or business license requirements (S)⁴ Fleet fuels use requirements (D) % of sales = zero emission vehicles (ZEVs) (D) (effectively electric vehicle sales requirement) 	<ul style="list-style-type: none"> Investment tax credit (S) Tax deductions for investment (S) Loan guarantees/bond support/loans (S) Fuel fees or taxes (D) Ratepayer support for utility-supplied fuels (S) Direct \$ support for favored fuels or production/distribution infrastructure (S)² High-occupancy vehicle (HOV) facility/parking access if using favored fuels (D) Fuel-cycle CO₂ fees (D)⁵ Emissions-related fees (D)⁶ Emissions reduction credits (D)⁶ Credits for alternative fuel use in a ridership or congestion management program 	<ul style="list-style-type: none"> Government investment or co-investment (S) in fuel production/distribution facilities

Notes:

* "S" denotes a measure that aims mainly to encourage the supply or availability of alternative fuels. "D" denotes a measure that aims mainly to encourage the demand for alternative fuels.

1) Fuel pool averaging denotes a flexible averaged regulation establishing overall standards for nonpetroleum energy use in all transportation fuels sold.

2) Includes alternative fuel tax credits, alternative fuel blending credits, exemption for excise taxes, sales taxes, and/or property taxes, grants, and other forms of direct support or subsidy.

3) As an example, fuel pool averaging would allow credits against a gasoline benzene standard for non-gasoline transportation fuels sold.

4) Refers to conditions requiring alternative fuel availability in a land-use permit (as for gasoline stations) or a business license.

5) Would favor most biomass-derived fuels.

6) Emissions-related incentives tend to favor clean nonpetroleum fuels.

Table 9-3

Possible Measures to Promote Alternative-Fuel Vehicles (AFVs)

RDD	Requirements/Standards	Incentives	Government Investment
<ul style="list-style-type: none"> Government RDD on AFV technologies 	<ul style="list-style-type: none"> Vehicle efficiency standards (S)^{*3,8} Vehicle fuel economy minimum, with credits for AFVs (S)⁸ Vehicle CO₂ emissions standards (S)⁷ Vehicle weight limits⁸ Low emissions standards with reactivity adjustments (S)⁵ % of sales = AFVs (S) Fleet rules for AFVs (D) Government fleet AFV purchase requirements (D) AFV requirements for government lease vehicles (D) (especially for vehicle rentals and transportation services) AFV requirements for government bidders (D) Vehicle purchase fuel economy minimums or standards or weight/horsepower limits for fleets (D) with credits for AFVs⁸ % of sales = ZEVs (S)⁹ Fleet rules requiring low-emission vehicles (LEVs) (D)¹⁰ 	<ul style="list-style-type: none"> Vehicle efficiency standards or fuel economy minimums with incentives for AFVs (S)^{1,3,8} Investment tax credits or deductions (S) Tax credits or deductions for AFV vehicle cost or incremental vehicle cost (D) Exemptions from license fees, registration fees, sales taxes, excess taxes, ad valorem taxes, use fees (D) Direct cost support for AFVs HOV/parking access for AFVs (D) Scoring preferences for government bidders with AFV programs (D) Land-use measures to enhance utility of electrical vehicles (EVs) (D) Direct cost support for fuel-efficient vehicles (D)^{4,8} DRIVE+ “feebates” for fuel efficiency with AFV credits (D)^{2,6} Gas guzzler taxes with credits for AFVs (D)⁸ DRIVE+ “feebates” based on emissions performance (D)² 	<ul style="list-style-type: none"> Government investment or co-investment in alternative-fuel vehicle production facilities

Table 9-3

**Possible Measures to Promote Alternative-Fuel Vehicles (AFVs)
(continued)**

RDD	Requirements/Standards	Incentives	Government Investment
		<ul style="list-style-type: none"> • Direct cost support for low-emission vehicles (D) • Ridership-rule or traffic congestion program credits for clean fuel vehicles (D) 	

Notes:

- * "S" denotes a measure that aims mainly to encourage the supply or availability of alternative-fuel vehicles. "D" denotes a measure that aims mainly to encourage the demand for alternative-fuel vehicles.
- 1) Provided in Alternative Motor Fuels Act of 1988.
 - 2) Feebates are intended to be revenue neutral, with fee revenues equaling rebate obligations.
 - 3) Federal law currently appears to preempt independent state action; preemption may be subject to litigation.
 - 4) Could include rebates, grants, tax credits and deductions, exemptions from all or part of taxes such as registration/license fees, sales taxes, excise taxes, ad valorem taxes, use fees.
 - 5) States would have to opt in to California standards or demonstration program. Low emissions standards may favor clean nonpetroleum fuel technologies.
 - 6) State feebates for an energy efficiency or fuel economy purpose may be preempted by federal CAFE legislation.
 - 7) Federal law probably prohibits state action.
 - 8) Can favor AFVs if credits or incentives are provided for vehicles using nonpetroleum fuels.
 - 9) ZEV = "zero emissions vehicle," presumably as defined in California emissions standards.
 - 10) LEV = "low emissions vehicle," referring to vehicles meeting lower emissions standards than some baseline standards, perhaps as defined in California emissions regulations or in "clean fuel vehicles" as defined in Clean Air Act Amendments of 1990. Low emissions standards may favor clean nonpetroleum fuel technologies.

- fuel production and distribution; and
- pricing.

This approach may be appropriate to an energy emergency (see Hawaii Energy Strategy Project 6, Energy Vulnerability Assessment and Contingency Planning) where speed and decisiveness may be more important than “optimum” energy choices. This approach has been used in wartime economies and in South Africa to promote energy independence during international economic sanctions. It was fundamentally the approach followed by Brazil in the 1980s to increase ethanol use in vehicles, the most rapid deep substitution of petroleum fuels ever achieved in an industrialized society. About half of the gasoline use was displaced by ethanol in approximately 10 years. More moderate forms of this approach might be considered where local economic interests in alternative fuels are very significant, such as in Hawaii.

Although direct government investment for transportation infrastructure is common (highways, transit, ports), the use of government investment has not been common in the U.S. to influence transportation energy use.² Nonetheless, government investment in alternative fuel production or AFV manufacturing facilities may be appropriate when the local economy would benefit but private investment is hesitant because of market uncertainties.

9.2.2 INCENTIVES

Incentives can be financial or non-financial.

With financial incentives, government chooses favored fuels, offers financial incentives, attempts to steer the market, but does not become a direct investor. Nevertheless, by choosing fuels and specifying incentives, government implicitly participates in pricing and therefore intrudes into the market.

Some proposed programs are “revenue-neutral.” Revenues from fees on “discouraged” vehicles or fuels fund the rebates of “encouraged” vehicles or fuels.

Incentives can range from strong to weak, and include such measures as:

- take or pay contracts which guarantee purchase volumes at defined prices;
- low-interest, no-interest, or guaranteed loans;
- direct subsidies;
- tax relief (credits, deductions, and exemptions);
- government bond issues;
- direct credits for sales of alternative fuels;
- extra taxes on gasoline and diesel fuel; and
- extra taxes for vehicles that can only use gasoline or diesel fuel.

² Except perhaps in wartime.

Tables 9-2 and 9-3 list incentives that have been proposed to encourage energy diversification, increased fuel economy, and cleaner vehicles. Most of these measures have been implemented either nationally or in select localities. Hawaii has seen similar proposals, including excise tax exemptions, tax credits, exemptions from registration fees, and “feebate” (revenue neutral) approaches to encouraging fuel-efficient or alternative-fuel vehicles. Bond issues for alcohol production facilities and AFV manufacturing have also been enacted in Hawaii.

Financial incentives were the main approach used to introduce unleaded gasoline and catalyst-equipped vehicles into European countries. This approach was also used to encourage natural gas vehicle technologies in Canada and New Zealand.

Financial incentives are a key part of the Energy Policy Act (EPACT) (see Chapter 4). Table 9-4 summarizes other federal incentives available for alternative fuels. (For more information see U.S. Senate, 1992; U.S. Department of Energy, 1992.)

An important incentive is created when regulated utilities are allowed to place certain costs of providing transportation energy into the pool of expenses that are covered by all the purchasers of the energy provided by the utility. When this treatment applies to capital costs it is termed “ratebasing,” the form of capital recovery used by regulated utilities. However, in some state and local programs, AFV operating costs have been recovered from all ratepayers, and not just the owners of AFVs. If implemented in Hawaii, this incentive would allow the electric utilities to “ratebase” their costs in providing an electric vehicle (EV) recharging infrastructure and other components to promote EV utilization in which the utility chose to invest.

“Ratebasing” is usually proposed as a short-term measure and is typically justified in relation to long-term public benefit and the need to explore pre-commercial emerging technologies. Long-term deployment of alternative fuel technologies by regulated monopoly utilities is generally thought to be a function of the investors, not the ratepayers. This is especially true where there are competing forms of transportation energy in the market, so that consumers are not dependent on one delivery infrastructure.

Non-financial incentives include preferential parking and lane access for high-occupancy vehicles (HOVs). Such proposals have been made in Hawaii.

9.2.3 MANDATES AND STANDARDS

Mandates entail government selection of favored fuels, but not investment and pricing decisions. Examples include:

- fuel specifications;
- fleet purchase requirements; and
- requirements on manufacturers to supply AFVs.

Table 9-4

**Other Federal Incentives for Alternative Motor Fuels:
Alcohol Fuel Credits
(Ethanol and Methanol Produced from Biomass)**

- Alcohol mixtures credit (to blender)¹
 - 54 cents per gallon of alcohol of at least 190 proof (or 5.4 cents excise tax exemption for 10% blends, 4.16 cents for 2.2% blends, 3.08 cents for 5.7% blends)
 - 40 cents per gallon of alcohol between 150 and 190 proof
- Pure alcohol credit (to retail seller)¹
 - Same as for mixtures credit
- Some ethanol producer credit
 - 10 cents per gallon of ethanol produced from plants of less than 30 million gallons per year, for up to 15 million gallons produced each year

Note:

- 1) Credits count as income and are limited to 25% of liability or 50% of minimum tax, therefore, the excise tax exception is usually preferred.

Mandates are generally viewed as less intrusive than financial incentives because most mandates establish a functional specification and let fuel providers and equipment manufacturers respond with market-driven approaches. Government avoids direct involvement in pricing.

For example, unleaded gasoline was introduced in the U.S. by a mandate that it be made available to support the catalyst-equipped automobiles that manufacturers offered in response to improved emissions standards. The Clean Air Act Amendments of 1990 mandated new reformulated gasolines with oxygenate requirements. While emissions standards appear “fuel neutral” since they do not reference specific fuels, they can be used to encourage cleaner alternative fuels if emissions standards are set low enough.

Mandates are perhaps the most aggressive feature of EPACT, which includes requirements for certain fleets to purchase a specified proportion of AFVs when new or replacement vehicles are purchased (see Chapter 4). Some state and local governments have instituted similar provisions for their fleets, such as transit buses. Such proposals have also been made in Hawaii.

Government standards (a form of mandate) effectively control gasoline and diesel fuel emissions, but leave the details to the fuel providers. These standards address sulfur and aromatic limits for diesel fuel, vapor pressure, sulfur, and oxygen requirements in gasolines.

Certain governments have established standards that explicitly promote alternative fuels and others have tried to achieve the same effect by specifying oxygen content. These standards have been actively supported by those interested in the use of alcohols in motor fuels. Ethanol has frequently been used to meet oxygen requirements in gasolines, but ethers produced from ethanol and methanol are used as well.

For energy diversification, "content" standards have been proposed and were implemented in Brazil in the early years of its ethanol program.³ In the case of Brazil, the content requirement was for ethanol. The 1994 session of the Hawaii Legislature passed an ethanol content standard (Act 199).

Content standards are regarded as supply-side measures since they promote the availability of alternative fuels or AFVs. From the viewpoint of alcohol producers, alcohol content requirements create a new demand. In Hawaii, for example, Act 199 of the 1994 legislature is expected to create a demand for ethanol and this demand is expected to spur the supply of ethanol, with benefits for the agriculture industry.

9.2.4 RESEARCH, DEVELOPMENT AND DEMONSTRATION PROGRAMS (RDD)

The government has long played a role in basic research for the common benefit that improves fundamental understanding and helps stimulate basic breakthroughs. Since U.S. business investment often focuses on short-term payoffs, government RDD programs can be particularly appropriate when technical risks are high and development times are long. Programs can involve both government and the private sector,⁴ and government research can complement private research.

RDD programs improve alternative fuel technologies and help ease their introduction by giving potential users familiarity with the technologies. Current government research on alternative transportation fuels is actually at a relatively low level. Total U.S. Department of Energy (U.S. DOE) expenditures on alternative motor fuel production and utilization currently average about \$200 million annually (U.S. DOE, 1993; Gross, 1993). For comparison, expenditures for the Clean Coal Program are about \$475 million, and total fossil energy research and development expenditures are about \$2 billion. The total U.S. DOE budget is about \$17 billion.

Alternative motor fuel programs are also supported by the Department of Defense (fiscal year 1994 commitments are about \$14 million), the Environmental Protection Agency and some state energy and air quality agencies. EPACT includes provisions to expand research on

³ Ethanol was required to be added to gasoline to provide an early market for ethanol before dedicated ethanol cars gained significant market share.

⁴ For example, the cooperative effort between the U.S. carmakers and the Clinton Administration aimed to develop the "car of the future" focuses on improved fuel economy, reduced emissions, and alternative fuels. EPACT contains important research programs.

advanced vehicles. The Clinton Administration has also announced their Clean Car Initiative, an RDD program with an emphasis on defense conversion. Hawaii is receiving \$5 million from the Defense Advanced Research Projects Agency in fiscal year 1994 to fund an electric vehicle demonstration program.

Vehicle manufacturers, the utility industry, and the fuel suppliers also conduct research and development on alternative motor fuels. No comprehensive compilations of these private expenditures are available, but it is unlikely that in the aggregate they exceed U.S. DOE expenditures for alternative fuels. Thus, although energy use in the transportation sector is substantial compared with other energy uses, RDD expenditures devoted to alternative fuels are rather small compared with expenditures aimed at increasing the overall energy supply or decreasing the environmental impacts of energy use. Nevertheless, government RDD leadership in alternative motor fuels is important, especially in the case of battery and fuel-cell electric vehicles and other advanced technologies.

9.2.5 ADJUSTMENT OF FUEL TAX RATES ON THE BASIS OF ENERGY CONTENT

Adjusting fuel tax rates on the basis of energy content would remove a disincentive to the use of alternative fuels. This is not a tax incentive. Taxing alternative fuels based on the energy content of those fuels would have no effect on the total amount of revenue received by the highway fund.

Motor fuels are taxed on a per-gallon basis. This puts most alternative fuels at a disadvantage on a cost-per-mile basis, since alternative fuel vehicles use more gallons to travel the same distance (see Figure 1). As the fuel tax laws are currently written, alternative fuels are taxed at the same per-gallon rate as diesel in spite of the difference in their energy content. This results in the operator of a methanol-powered vehicle (center illustration, Figure 9-1) paying more than twice as much in fuel taxes than as for a diesel-powered vehicle (top illustration, Figure 9-1).

However, if fuel taxes for alternative fuels were based on energy content, the amount of fuel tax paid by the operator of an alternative fueled vehicle (bottom illustration, Figure 9-1) would be the same as for a conventionally-fueled vehicle (top illustration, Figure 9-1).

An adjustment to fuel tax rates, even prior to the alternative fuels being available, is important for several reasons. First, costs are a significant consideration for a fleet considering the use of alternative fuels. The current system of taxing fuels on the basis of volume (rather than energy content) results in a significant additional cost item. The barrier is sizable; for a fleet of ten heavy-duty vehicles traveling 10,000 miles per vehicle per year, the additional highway taxes imposed due to fuel choice could be thousands of dollars (see Figure 9-2).

Figure 9-1
Alternative Fuels Have Less Energy Per Gallon;
Therefore, More Gallons are Used to Travel the Same Distance

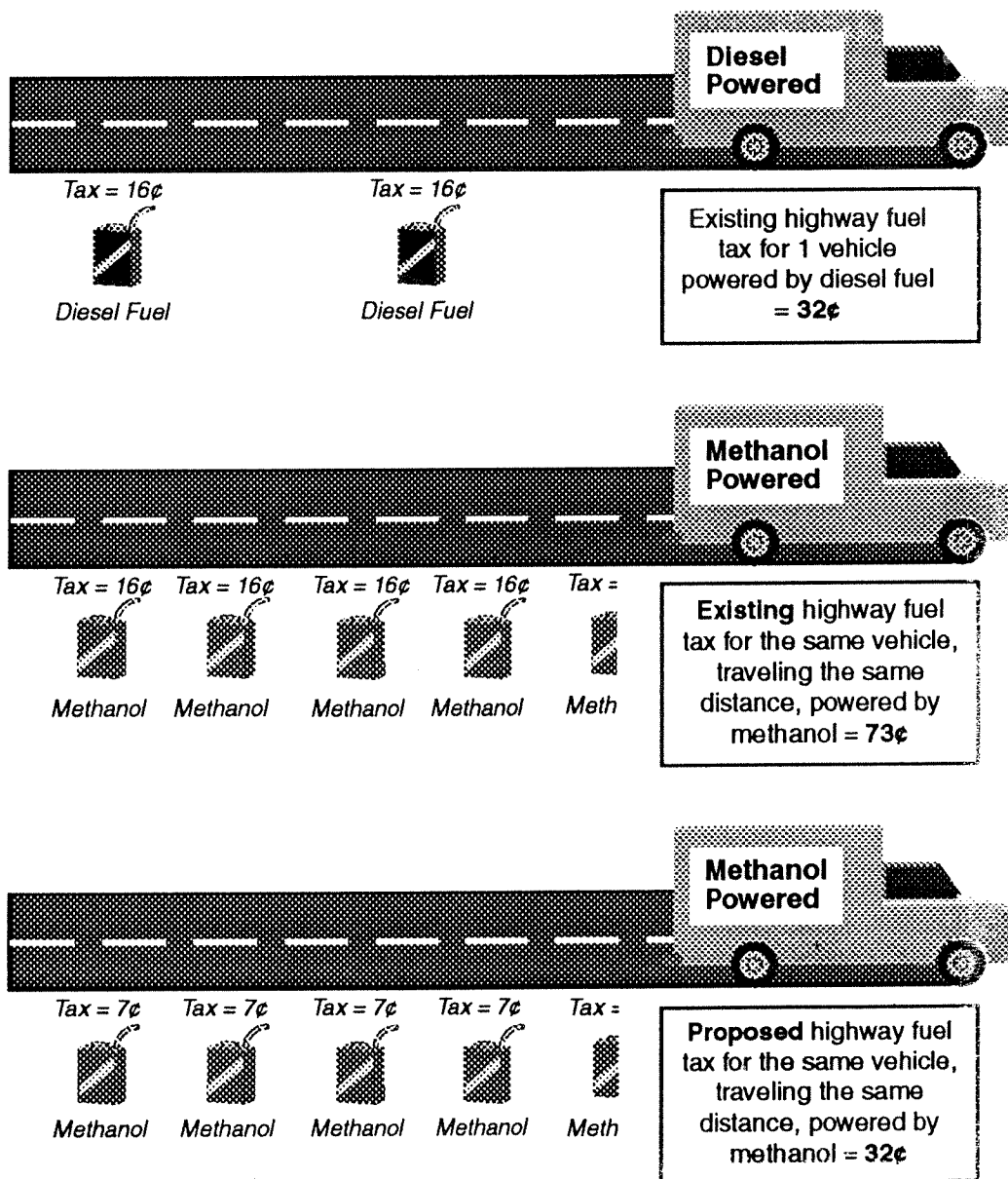
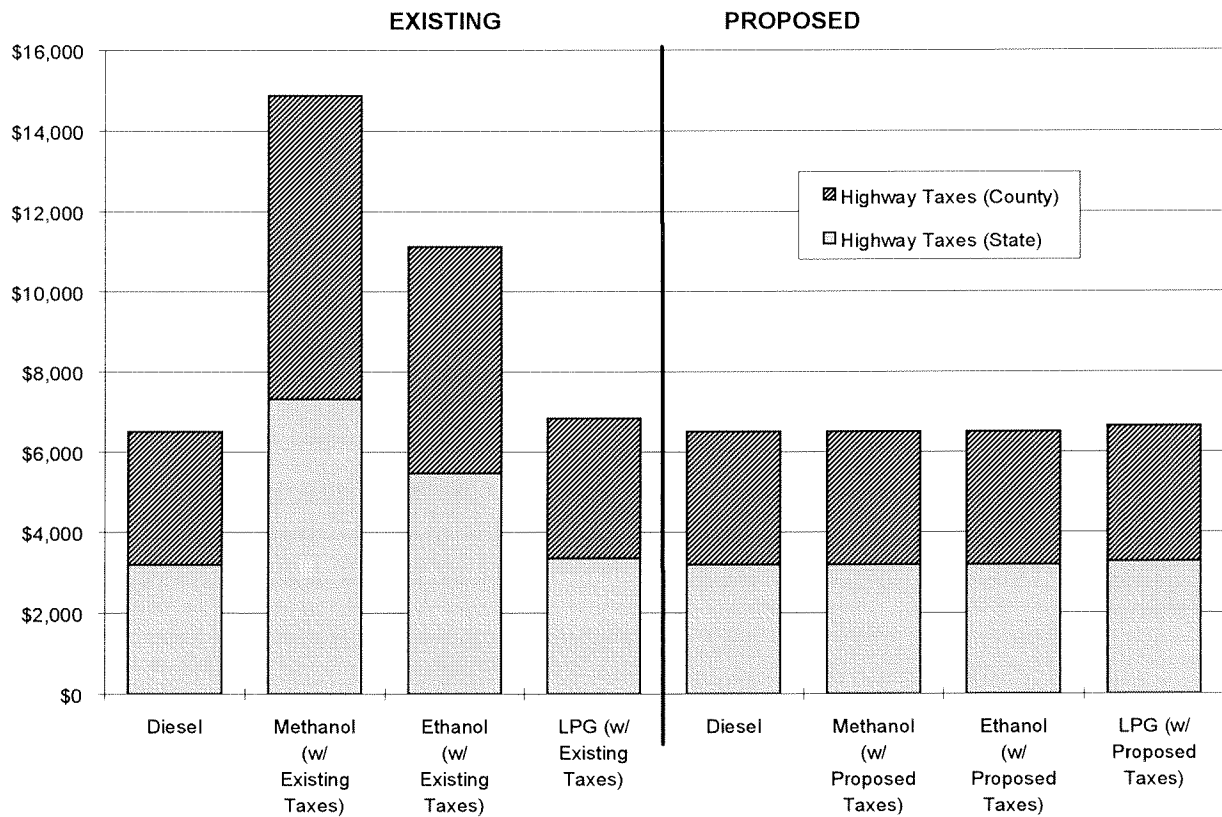


Figure 9-2
Annual State and County Highway Taxes
Assuming a Fleet of 10 Heavy Duty Vehicles Traveling 10,000 Miles Per Year



Taxes which are assessed on a per-gallon basis ("existing" rates, above) result in uneven annual charges for different fuels. As shown in the graph, the "proposed" rates would result in the same revenue for the same vehicle-miles traveled, regardless of fuel type.

Second, even if fuel production, transport, and vehicle costs for alternative fuels (see Chapter 8) are brought down to be on a par with conventional fuels, as long as the tax rates are higher for the alternative fuels, they will not be price-competitive. Therefore, before even considering incentives or other measures for alternative fuels, the issue of fuel taxes should be addressed. This measure is completely fuel-neutral, requires no revenue, and there is even a precedent for such an adjustment.

An adjustment to fuel tax rates has already been implemented in the case of liquefied petroleum gas (LPG); the current tax rate is "two-thirds the rate for diesel, rounded to the nearest cent." As shown in Figure 9-2, this rate results in the existing taxes on propane being roughly on a par with diesel.

A similar adjustment could be extended to the other alternative fuels as well by replacing the phrase "liquefied petroleum gas" with the term "alternative fuels" and specifying the following rates:

Table 9-5
Proposed Adjustment to State and County Highway Tax Rates

Fuel	Approximate factor (nearest fraction)	Proposed factor (decimal)
Methanol	3/7	0.437
Ethanol	3/5	0.585
LPG	2/3	0.649

9.3 CONCLUSION

There is a wide range of possible measures which could move Hawaii towards a greater use of alternative fuels for transportation. Some, such as government-provided fuel, involve extensive government involvement. Others, such as research, development and demonstration programs, are investment for long-term societal goals such as energy security, economic development, or environmental preservation. And still others, such as adjustment of fuel taxes to reflect the lower energy content of alternative fuels, simply reduce existing barriers without promoting any particular fuel or set of fuels.

The next chapter explores potential benefits of alternative fuels and estimates the costs and effectiveness of the various possible alternative fuel measures.